



INVESTOR IN PEOPLE

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Concept House  
Cardiff Road  
Newport  
South Wales  
NP10 8QQ

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Dated 20 March 2002

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Patents Form 1/77  
Patents Act 1977  
(Rule 16)



The  
Patent  
Office

09JUL99 E460854-6 D02917  
P01/7700 0.00 - 9916085.5

## Request for grant of a patent

The Patent Office  
Cardiff Road  
Newport  
Gwent NP9 1RH

1. Your reference  
**1830301/AM**
2. Patent Application Number  
**9916085.5**
3. Full name, address and postcode of the or of each applicant (*underline all surnames*)  
**Scientific Generics Limited**  
**Harston Mill**  
**Harston**  
**Cambridgeshire CB2 5NH**  
*560874003*  
Patents ADP number (*if known*) *560874003*  
If the applicant is a corporate body, give the country/state of its incorporation  
Country: **ENGLAND**  
State:
4. Title of the invention  
**FREE SPACE OPTICAL COMMUNICATION SYSTEM WITH FULL DUPLEX OPERATION**
5. Name of agent  
**Beresford & Co**  
"Address for Service" in the United Kingdom to which all correspondence should be sent  
**2/5 Warwick Court**  
**High Holborn**  
**London WC1R 5DJ**  
Patents ADP number *1826001*
6. Priority details  
Country                      Priority application number                      Date of filing

## Patents Form 1/77

7. If this application is divided or otherwise derived from an earlier UK application give details

Number of earlier of application

Date of filing

8. Is a statement of inventorship and or right to grant of a patent required in support of this request?

YES

9. Enter the number of sheets for any of the following items you are filing with this form.

Continuation sheets of this form

Description

2

Claim(s)

Abstract

Drawing(s)

2

2

10. If you are also filing any of the following, state how many against each item.

Priority documents

Translations of priority documents

Statement of inventorship and  
right to grant of a patent (*Patents form 7/77*)

1 + 2 COPIES

Request for preliminary examination  
and search (*Patents Form 9/77*)

Request for Substantive Examination  
(*Patents Form 10/77*)

Any other documents  
(*please specify*)

11. I/We request the grant of a patent on the basis of this application

Signature

BERESFORD & Co

Date

8 July 1999

12. Name and daytime telephone number of  
person to contact in the United Kingdom

ALAN MACDOUGALL

Tel:0171-831-2290

Patents Form 7/77  
Patents Act 1977  
(Rule 15)



**The  
Patent  
Office**

**Statement of inventorship and of  
right to grant of a patent**

The Patent Office  
Cardiff Road  
Newport  
Gwent NP9 1RH

1. Your reference  
1830301/AM 08 JUL 1999
2. Patent Application Number  
accompanying application reference 1830301 **9916085.5**
3. Full name of the or each applicant  
Scientific Generics Limited
4. Title of the invention  
FREE SPACE OPTICAL COMMUNICATION SYSTEM WITH FULL DUPLEX  
OPERATION
5. State how the applicant(s) derived the right from the inventor(s) to be granted a patent  
BY VIRTUE OF EMPLOYMENT.
6. How many, if any additional Patents Forms  
7/77 are attached to this form?  
NONE
11. I/We believe that the person(s) named over the page (and on any extra copies of this form) is/are  
the inventor(s) of the invention which the above patent application relates to.  
  
Signature Beresford & Co Date 8 July 1999  
BERESFORD & Co
12. Name and daytime telephone number of  
person to contact in the United Kingdom ALAN MACDOUGALL  
Tel: 0171-831-2290

Patents Form 7/77

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## **Free Space Optical Communication System with Full Duplex Operation**

### **Background**

The applicant has described in WO98/35328 an optical communication system employing a pixellated reflective modulator array combined with a telecentric optical system. The system operates by assigning each user of the system a unique pixel in the array. Each pixel in the array maps to a unique angular position in the field of view of the telecentric optical system (figure 1). The content of WO98/35328 is incorporated herein by way of reference.

The system described in WO98/35328 is capable of operation in a half duplex mode, where a spatially matched detector array is employed, and the laser source is shared between the two data direction in a time division manner. Thus the data bandwidth available in each direction is half that which would be available in a simplex system of the same design.

Our invention concerns the extension of such system to full duplex operation.

### **Description of the Invention**

In the following description, we refer to communication between the modulator and the receiver as the 'downlink' and between the receiver and the modulator as the 'uplink'.

It is advantageous to employ a common optical channel between uplink and downlink. This eases installation, as there are no additional optics to align, and also avoids extra cost. According to our invention, we employ a second laser source at the 'receiver' end and a spatially matched detector array at the 'modulator' end, to implement the uplink. These are optically combined with the existing optical arrangement so that the optical is shared with the downlink. This is shown in figure 2.

According to the first aspect of our invention, the additional laser is at the same wavelength as the receiver's existing laser, but is oriented such that its polarisation state is orthogonal to the existing laser. Alternatively, it may be mounted in the same orientation as the existing laser, but then had its output polarising rotated by 90° using a half-wave retardation plate. A polarising beam splitter is used at the 'modulator' end of the link to separate the uplink signal onto the detector array (see figure 3).

The downlink signal passes through the polarising beamsplitter and on to the modulator array. Thus uplink and downlink signals are transmitted on orthogonal polarisation states. As described in WO98/35328, it is advantageous to convert the signal to circular polarisation states, as this allows efficient separation of the retro-reflected signal onto the receiver photodetector. In the case of our invention, there is

an additional advantage in that the use of circular polarisation removes the need for precise angular alignment of the ends of the link about the optical axis.

According to the second aspect of our invention, the additional laser at the 'receiver' end has a different wavelength to the existing laser. The combining and separating optics consist in this case of dichroic beamsplitters. In this aspect of our invention, the uplink and downlink are separated in wavelength, but may operate in the same polarisation state.



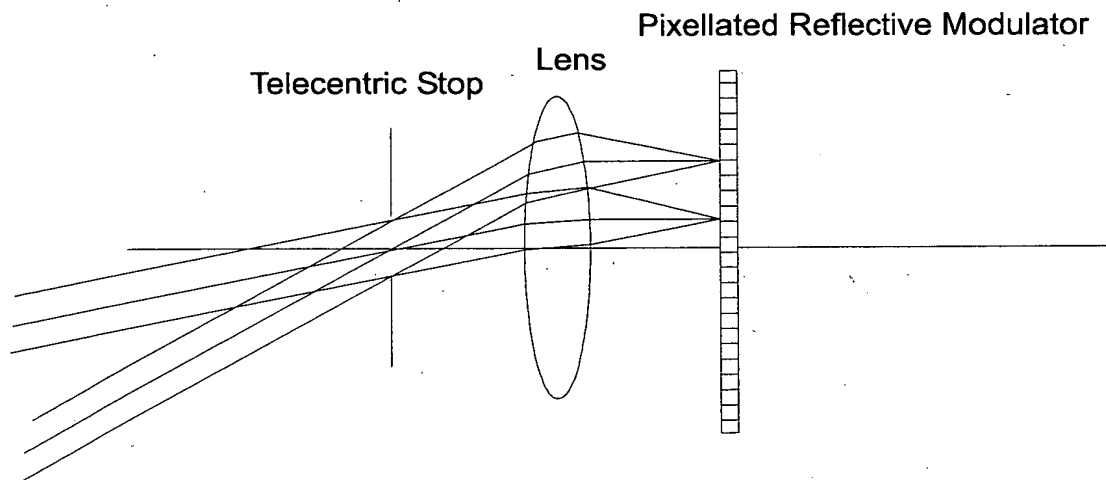


Figure 1

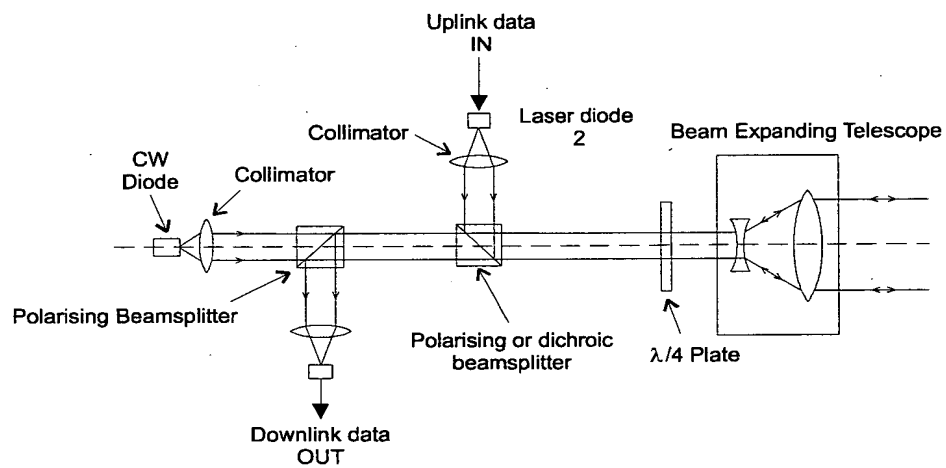


Figure 2

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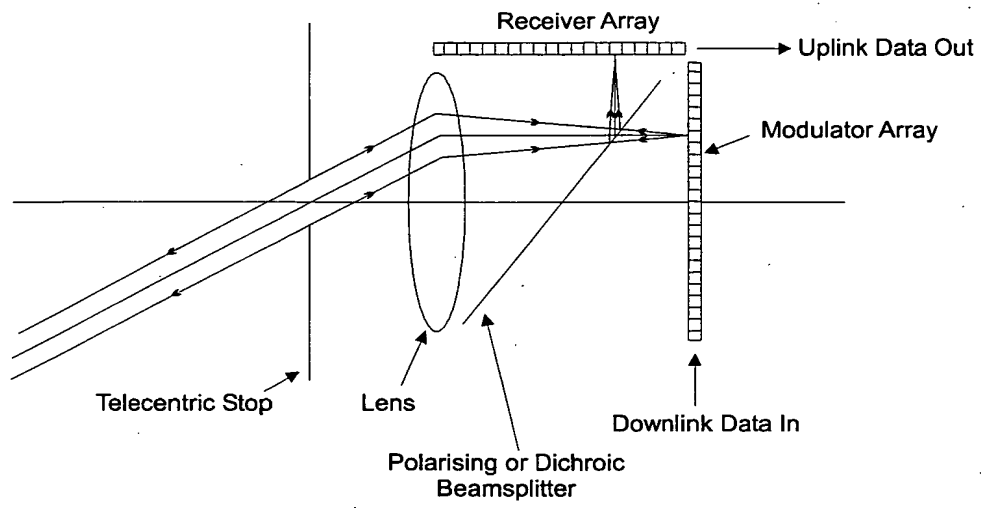


Figure 3

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